WHAT IS CLAIMED IS:

1. A device for measuring the movement of an object comprising:

a. means for creating time-varying magnetic fields at least large enough to surround the object;

b. electrical circuits adapted to conform to the surface of the object;

c. noise reduction circuit means for reducing the sum of signals from an unwanted magnetic field of uniform intensity that is influencing the fields created to surround the object to zero; and

d. voltage monitoring means connected to the electrical circuits, whereby motion of the surface creates a measurable change in induced voltage in the circuits that correlates to the movement of the object.

2. The device of claim 1 in which the voltage monitoring means is connected to a computing means suitable for performing a series of algorithmic steps to calculate the volume change of the object from the measured induced voltage.

3. The device of claim 1 in which the electrical circuits are adapted to conform to one or more portions of a human body comprising the object.

4. The device of claim 1 in which the device generates current with a frequency range of about 10 kHz to about 200 kHz and from about 1 milliampere to about 1 ampere.

5. The device of claim 3 in which the electrical circuits comprises a plurality of coil loops which are configured tightly about the thoracic region and the abdominal region of the human body.

6. The device of claim 1 further comprising sensing and control means for controlling operation of the device.

7. The device of claim 6 in which the sensing and control means comprises timing and multiplex switching means for providing simultaneous volume measurements of both a thoracic region and an abdominal region of the object.

8. The device of claim 7 in which the sensing and control means comprises multiplexing means for providing simultaneous measurement of a plurality of regions of the object utilizing either phase, frequency or time multiplexing.

9. The device of claim 1 comprising a constant current circuit to maintain the current in the electrical circuits constant regardless of the dynamic variations of portions of the electrical circuits that are configured tightly about the various circumferences of at least one portion of the object.

10. The device of claim 1 comprising a signal generator and a constant current amplifier.

11. The device of claim 6 in which the sensing and control means comprises an amplifier and a rectifier electrically connected to the electrical circuits that are receiving the induced voltage.

12. The device of claim 2 in which the electrical circuits comprises conductive coils which are electrically connected in series so that the instantaneous volume V may be calculated from the voltage reading U of the volume output signal in the coils which is receiving induced voltage by use of the formula

$$V = U \bullet d \bullet k_c$$

wherein d is the spacing between the coils;

and $k_c = a_c / U_c$;

wherein a_c is the area of a reference coil, and U_c is the voltage reading of the volume signal when a calibration coil is attached.

13. The device of claim 1 in which the means for creating time-varying magnetic fields comprise fixed coil means having a plurality of small coil elements that are configured for matching and positioning to permit the fixed coil means to generate a homogeneous magnetic field similar to a single large coil for either sensing an induced voltage from the conductive coil means or for generating a field to create an induced voltage in the conductive coil means.

14. The device of claim 13 in which the plurality of small coil elements comprises three small coil elements.

15. The device of claim 14 in which each of the small coil elements is wound on a ferrite core and arranged linearly with optimized positions and signal intensity weighting to generate a homogeneous magnetic field at the portion of the mammal being measured.

16. The device of claim 1 in which the electrical circuits comprise conductive coil means having electrically conductive coil loops that are equally spaced and carried by an elastic and conformable substrate that is suitable for wearing by the object in a manner similar to a tightly fitting garment which is configured so that the coil loops always conform to the same surface of the portion of the object regardless of any shape change which that portion of the object may experience during respiration.

17. The device of claim 1 in which the electrical circuits comprise conductive coil means having electrically conductive coil loops that are spaced at constant and known intervals and which are carried by an elastic and conformable substrate that is suitable for wearing by the object in a manner similar to a tightly fitting garment which is configured so that the coil loops always conform to the same surface of the portion of the object regardless of any shape change which that portion of the object may experience during respiration.

18. The device of claim 1 further comprising computational means for receiving a signal representative of sensed volume of the portion of the object and for converting the signal to true volume values.

19. A device for measuring the signals corresponding to the values of area or volume of at least one object within a homogeneous magnetic field, comprising:

a. conductive coils configured tightly about the various circumferences of at least one portion of an object within a homogeneous magnetic field;

b. fixed coils remotely located relative to the conductive coils about the object;

c. a noise reduction coil circuit arrangement for reducing the sum of signals to zero from an unwanted magnetic field of uniform intensity that is influencing the magnetic field surrounding the object; and,

d. current generating means for selectively providing alternating current to either one of the conductive coil means or the fixed coil means to create an induced voltage in the other coil means representative of true area or volume within the coils that are configured tightly about the various circumferences of the object portion or portions, with the signals and area/volume changing over time due to the cardiac function of the object.

20. The device of claim 19 in which the conductive coils comprise electrically conductive coil loops that are equally spaced on a flexible substrate that is suitable for wearing by the object.

21. The device of claim 19 in which the conductive coils comprise electrically conductive coil loops that are closed circumferential loops.

22. The device of claim 19 in which the current generating means generates current with a frequency range of about 10 kHz to about 200 kHz and from about 1 milliampere to about 1 ampere.

23. The device of claim 19 in which the conductive coils comprise a plurality of coil loops which are configured tightly about the thoracic region and the abdominal region of the object.

24. The device of claim 19 further comprising sensing and control means for controlling operation of the device, the sensing and control means being electrically connected to the conductive coils, the fixed coils, the noise reduction circuit, and the current generating means.

25. The device of claim 24 in which the sensing and control means comprises timing and multiplex switching means for providing simultaneous area or volume measurements of both a thoracic region and an abdominal region of the object.

26. The device of claim 25 in which the sensing and control means comprises multiplexing means for providing simultaneous measurement of a plurality of regions of the object utilizing either phase, frequency or time multiplexing.

27. The device of claim 19 in which the current generating means comprises a constant current circuit to maintain the current in the conductive coils constant regardless of the dynamic

variations of portions of the conductive coils that are configured tightly about the various circumferences of at least one portion of the object.

28. The device of claim 19 in which the current generating means comprises a signal generator and a constant current amplifier electrically connected to the coils which are receiving the generated current.

29. The device of claim 24 in which the sensing and control means comprises an amplifier and a rectifier electrically connected to the coils that are receiving the induced voltage from the other coils.

30. The device of claim 20 in which the conductive coils are electrically connected in series so that the area A may be calculated from the measured voltage U of a single coil loop which is receiving the induced voltage by use of the formula

$$A = U \bullet k$$

wherein $k_c = a_c / U_c$; and

wherein a_c is the area of a reference coil, and U_c is the voltage reading of the volume signal when a calibration coil is attached.

31. The device of claim 19 in which the fixed coils comprise a plurality of small coil elements that are configured for matching and positioning to permit the fixed coils to generate a magnetic field similar to a single large coil for either sensing an induced voltage from the conductive coils or for generating a field to create an induced voltage in the conductive coils.

32. The device of claim 31 in which the plurality of small coil elements comprises three small coil elements.

33. The device of claim 32 in which each of the small coil elements is wound on a ferrite core and arranged linearly with optimized positions and signal intensity weighting to generate a homogeneous magnetic field at the portion of the object being measured.

34. The device of claim 19 in which the conductive coils comprise electrically conductive coil loops that are equally spaced and carried by an elastic and conformable substrate that is suitable for wearing by the object in a manner similar to a tightly fitting garment which is configured so that the coil loops always conform to the same surface of the portion of the mammal regardless of any shape change which that portion of the object may experience during cardiac function.

35. The device of claim 19 in which the conductive coils comprise electrically conductive coil loops that are spaced at constant and known intervals and which are carried by an elastic and conformable substrate that is suitable for wearing by the object in a manner similar to a tightly

fitting garment which is configured so that the coil loops always conform to the same surface of the portion of the object regardless of any shape change which that portion of the object may experience during cardiac function.

36. The device of claim 19 further comprising computational means for receiving a signal representative of sensed area or volume of the portion of the object and for converting the signal to true area/volume values.

37. The device of claim 19 in which the noise reduction coil circuit arrangement comprises a combination of a plurality of coil orientations and coil turn numbers that bring the sum of undesired signals to zero.

38. The device of claim 37 in which the noise reduction coil circuit comprises matched pairs of coils.

39. A method of measuring the area or volume of an object comprising the steps of:

a. adapting electrical circuits as coils to conform to the object surface;

b. providing electrical circuits remotely located relative to said object;

c. generating a constant and known current in said electrical circuits to produce a relatively homogeneous spatial sensitivity in a defined region around the object;

d. providing a noise reduction circuit to reduce the sum of undesired received signals to zero in the defined region when all the electrical circuits in the defined region are exposed to an undesired uniform magnetic field; and

e. measuring the voltage induced in the electrical circuits by a time-varying uniform magnetic field surrounding the object, whereby the change in the area or volume of the object may be calculated without calibration of said electrical circuits to said object.

40. A method of measuring the area or volume of an object comprising the steps of:

a. adapting electrical circuits to the object surface;

b. providing electrical circuits remotely located relative to said object;

c. generating a constant and known current into one of said electrical circuits to produce a relatively homogeneous spatial sensitivity in a defined region around the object;

d. providing a noise reduction circuit to reduce the sum of undesired received signals to zero in the defined region; and

e. measuring the electromagnetic inductive coupling between the electrical circuits, whereby the change in the area or volume of the object may be calculated without calibration of said electrical circuits to said object.